

CLAIMS

1. A method of manually separating from a plurality of clouds of points, representing three-dimensional features in a scene, a subset of the points that represents a desired feature in the scene, the method comprising:

selecting all the point clouds that include at least some data points representing the desired feature; and

changing a view of the clouds and drawing a polygonal lasso to refine a selected subset of points to be included in a point sub-cloud and repeating the refining as many times as required to obtain the desired sub-cloud.

2. A method for automatically segmenting a scan field of a scene into subsets of points that represent different surfaces in the scene, comprising the steps of:

separating the scan field into a depth grid that includes depth information for scanned points of surfaces in the scene and a normal grid that includes an estimate of a normal to scanned points of the surfaces;

convolving the depth information of the depth grid to generate a depth rating image whose values represent a gradient of depth change from one scanned point to another scanned point in the scene;

convolving the components of the normal grid to generate a scalar value for each component for each point of the normal grid,

for each point of the normal grid, determining from the scalar values for the components of that particular point a gradient of the normal at that point, wherein the gradients determined for the

points of the normal grid collectively constitute a normal rating image;

converting the depth rating image to a binary depth image using a recursive thresholding technique;

5 converting the normal rating image to a binary normal image using a recursive thresholding technique;

combining the binary depth image and the binary normal image to determine a single edge image; and

10 grouping subsets of non-edge points as belonging to corresponding surfaces of the scene.

3. A method as recited in claim 2 further including the steps of:

15 determining the type of geometric primitive that would best first each group of points; and

fitting the geometric primitive to the data points.

4. A method as recited in claim 3 further including the step of intersecting adjacent planar regions in the scene.

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5. A method for fitting a point cloud representing a corner, comprising:

25 determining a fit of three planes to the points of the point cloud and creating the planes for a model;

determining the three lines at the intersection of pairs of planes and creating the lines for the model; and

30 determining the vertex point at the intersection of the three planes and creating a vertex point for the model.

6. A method for modeling a three-dimensional scene, comprising:

generating a plurality of points that each represent a point on a surface of the scene;

5 determining a best fit of a cylinder for a group of the points using surface normal estimates and global error minimization.

7. A method for modeling a three-dimensional scene, comprising:

10 generating a plurality of points that each represent a point on a surface of the scene;

determining a best fit of a cylinder for a group of the points using a quadric surface fit and global error minimization.

15 8. A method for modeling a three-dimensional scene, comprising:

generating a plurality of points that each represent a point on a surface of the scene;

20 determining a best fit of a sphere for a group of the points using a quadric surface fit and global error minimization.

9. A method for modeling a three-dimensional scene, comprising:

25 generating a plurality of points that each represent a point on a surface of the scene;

determining a best fit quadric surface for a group of points; and

30 determining which geometric primitive of a plurality of the family described by the quadric surface best fits the group of points.

10. A method for merging two geometric primitives of the same type to form a single geometric primitive of the type, comprising:

5 creating a new group of points by combining the points used to originally fit each of the two primitives; and

 fitting the new geometric primitive using any appropriate fitting technique and the newly generated point group with points from each of the original
10 primitives.

11. A method of registering a first model, consisting of a plurality of points and geometric primitives and having a first coordinate system, with a second model, consisting of a plurality of points
15 and geometric primitives and having a second coordinate system, comprising:

 identifying by a user common features of the first and second scenes ;

 identifying a transformation between
20 coordinate systems that is responsive to the identification; and

 transforming the objects of the second model so that they use the first coordinate system.

25 12. A method of warping, comprising:

 selecting one or more models represented by a plurality of point clouds and geometric primitives;

 specifying constraints on the locations of
30 any number of points or geometric primitives;

 creating an artificial volume that surrounds the points and geometric primitives in each view and assigning mechanical material characteristics to the surrounding volume;

computing a minimum energy configuration for the material in the surrounding volume in which the points or geometric primitives are embedded such that the configuration satisfies all applied constraints; and

displacing the points and primitives in accordance with the computed minimum energy configuration of the surrounding volume of material.

13. The method of claim 12, wherein the constraints are specified to eliminate closure errors.

14. An apparatus for acquiring three dimensional information from a remote object comprising:

a scanning laser module for measuring position information of the object;

a video module for capturing image information from the object; and

a processor for rendering a model of the object which includes the position information and the image information.

15. An apparatus as recited in claim 14 wherein the video image information is collected in a spatially coincident manner with the measurement of position information.

16. An approach as recited in claim 15 wherein the video image information is collected from points adjacent to the points where position information is obtained.